

Shell colourless, semitransparent; when young, pale purplish.

Inhab. China. N.W. Coast of Australia; *Earl of Derby*. Port Essington.

The shells vary a little in the inequality of the hinge-ridges, but the hinder is always the longest.

I may remark that Chemnitz gives the best character for the species, and has observed the character furnished by the hinge, which has been overlooked by Lamarck, and, as far as I am aware, by all recent authors.

MISCELLANEOUS.

The Effect of Iodine upon the Nectary. By Dr. R. CASPARY*.

WE consider the nectary as a peculiar organ, in a physiological as well as in a morphological sense; *physiological*, inasmuch as it secretes a saccharine fluid, and *morphological*, inasmuch as its cells are distinguished both by their structure and their contents from the cells of the neighbouring parts of the plant. The cells of the nectary are very small, globular or nearly so, and they contain a peculiarly dense and granular matter.

One of the most important inquiries connected with the physiology of the nectary is to ascertain, how the sugar which it secretes is produced?

This question is only, as we may consider, one special form of the general question, how is sugar produced?

Without entering minutely into the general inquiry, we will refer only to two modes of the production of sugar, which probably have a special bearing upon the case before us.

1st. Sugar is produced from starch by the presence of *diastase*, which however cannot be prepared as an independent substance, and the existence of which is consequently disputed. Its active element appears to be nitrogen, so that we may say that sugar is produced from starch *by the presence of a body containing nitrogen*.

2ndly. Sugar is produced from starch or cellulose by the presence of *sulphuric acid*.

Frémy has made use of the latter mode of the production of sugar in accounting for the sugar in fruits. He endeavours to demonstrate that as starch or cellulose is converted into sugar by sulphuric acid, so certain substances, present in fruits and taking the place of starch or cellulose, are changed into sugar by the presence of free vegetable acids, which act in a similar way to sulphuric acid. This mode of the production of sugar has not yet been alluded to in accounting for the sugar of the nectaries of plants.

The first mode of the production of sugar, according to which starch is changed into sugar by the action of a body containing nitrogen, is employed by Liebig in his 'Chemistry of Agriculture and Physiology,' in illustrating the formation of sugar in the trunks of trees, as in the maple. He however does not prosecute the subject

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to a great extent, and does not show by accurate observations or experiments that starch is always present in this process, or if it is not present, what substance acts in its place.

I have assumed the first mode of the production of sugar in accounting for the saccharine secretion of the nectary in a little paper, 'De Nectariis, Bonnæ, apud Adolphum Marcum,' 1848, p. 45 *seq.* I ought there to have demonstrated two things: first, the presence of starch in the nectary, or at least of a substance deposited in it and holding the place of starch; and, secondly, the existence of a body containing nitrogen, which should act upon the starch or other substance and convert it into sugar. I have endeavoured to demonstrate that such a body containing nitrogen, the formation of which takes place very near the nectary and which operates upon it, is to be found *in the pollen and in the ovules*, l. c. p. 35 *seq.*, and p. 48. I shall now proceed in these notes to give additional proofs of the effect of the substances containing nitrogen, which I conclude produce the nectar. In my former work I have ventured the supposition, that the variously-coloured granular substances deposited in the peculiar and globular or nearly globular cells of the nectary are actually starch, or at least hold the place of starch in the process. *The presence of starch in the nectary*, or the question as to whether the granular matter contained in the nectary be starch or not, is the subject of the following observations.

It is a well-known fact in chemistry and vegetable physiology, that iodine colours starch blue, and that it is a very delicate test. In answering, therefore, the question as to whether *the granular matter of the nectary be starch or not*, we shall submit the nectary to the action of iodine.

In the summer of 1848, I examined the nectaries of upwards of two hundred plants which are indigenous to the county of Norfolk in England. From the effect of iodine on the nectaries of those plants I obtained the following results. But before proceeding, I may be allowed to premise, that the iodine employed for the purpose was dissolved in weak spirits of wine, for I found it the most easy to manage in this form. If the iodine is dissolved in water, its action is not sufficiently rapid. If dissolved in more concentrated spirits of wine, it either colours too darkly, or on the addition of water under the microscope, disturbs the observation by the secretion of crystals.

The membrane of the cells of the nectary, like membrane in general, takes a yellow or brown colour, more or less deep, on the application of iodine. The nectary of *Euphorbia Peplus*, L., which has naturally a yellow colour, is hardly visibly affected by iodine. In a general way iodine colours the nectary much more deeply yellow or more deeply brown than the other parts of the flower, as the ovary, the style, the petals and sepals. This is the case in *Artemisia Absinthium*, L., *Lapsana communis*, L., *Filago germanica*, L. (male flower), *Bellis perennis*, L., *Sonchus oleraceus*, L., &c. In certain cases, in which there is some doubt as to the true site of the nectary, I would willingly be influenced by the effect of iodine, and assert, that that organ is the nectary which takes the darkest colour on the application

of iodine. I therefore conclude, in the case of *Knautia arvensis*, Coulter, that the nectary is a small cylinder under the style, and in *Succisa pratensis*, Mœnch., that it is a very peculiarly loose accumulation of cells at the base of the corolla, under the greatest lobe; and I arrive at this conclusion because these parts are coloured the most darkly by iodine, and because their structure is analogous to that of nectaries in general.

With respect to the contents of the cells of the nectary, we must carefully distinguish between the contents of the common cells and those of the pores. The contents of the former usually consist of a yellowish, greenish or uncoloured, transparent juice, and of a granular matter, the grains of which are sometimes so small that they are scarcely visible, even with a magnifying power of 550, the whole having the appearance of a mass of slime interspersed with traces of grains. In most cases however the grains are clearly visible. Their colour varies considerably, but is limited to the different shades of yellow, green, gray, brown, and obscure violet, though the last is but very rarely observed. It did not occur once in the two hundred plants I examined last year. The colour of the grains is generally the most readily detected when they are congregated one upon the other in small clusters. The individual grains are generally colourless and transparent. Sometimes in addition to the above-mentioned grains there are very large grains of the same globular form, but entirely transparent and free from colour, as in *Pedicularis palustris*, L. I need hardly mention, that there are also in the nectaries of plants, crystals, air-vesicles, &c., which have no reference to the present subject.

The grains contained in the cells of the nectary are also in most cases coloured yellow or brown by iodine.

In eleven plants iodine obviously colours the grains blue, and thus proves that they are starch. In four others it colours them a bluish-brown or a brownish-blue: *Armeria maritima*, Willd., *Hyoscyamus niger*, L., *Hypochaeris radicata*, L., and *Sinapis alba*, L. The eleven plants the grains of which become blue by the application of iodine are the following: *Pedicularis palustris*, L., *Arenaria media*, L., *Mentha arvensis*, L., *Malva moschata*, L., *Malva sylvestris*, L., *Clinopodium vulgare*, L., *Convolvulus sepium*, L., *Conv. arvensis*, L., *Lychnis sylvestris*, Hoppe, *Lychnis dioica*, L., *Bryonia dioica*, L. In the nectary of *Pedicularis palustris* only the above-mentioned larger and transparent grains take the blue colour. The nectary of *Arenaria media*, L., is the base of the sepals, where they abut upon the filaments, and the epidermis only contains starch. The nectaries of *Lychnis sylvestris* and *dioica* are on the gymnophorum between the bases of the petals and their processes. In *Lychnis sylvestris* I found evidence of starch only in the male flower, and in *L. dioica* only in the female flower. The grains of starch vary very much in size. The diameter of the largest is only about one-fourth of the diameter of a common grain of potato-starch, and the smallest grains are scarcely visible even with a magnifying power of 550. The form of the grains is irregular, but more or less globular. Though coloured by iodine they remain transparent, and generally show a

somewhat darker spot in the centre, which is probably a small hollow space, such as may often be seen in starch. Beside the dark spot in the centre I observed layers in the starch of *Clinopodium vulgare*, but there were only two in the largest grains. Iodine sometimes does not act upon the grains till after the lapse of some minutes, as in *Convolvulus arvensis*.

Before I speak of the effect of iodine upon the pores, I must premise, that the pores which are found in the nectaries of many plants have, with but few exceptions, a row of globular grains on the exterior margin, distinguished by their size, transparency, and freedom from colour. I found no trace of these grains in the pores of four of the plants I examined last summer, viz. *Cakile maritima*, Willd., *Euphrasia officinalis*, L., *Statice Limonium*, L., *Sedum Telephium*, L. Iodine had a different effect on the grains of these pores, although in their physical properties they appear to be identical. In seven plants they became blue, and in fourteen brown, of a deep shade, much browner than any other part of the nectary. But whether they became blue or brown, the effect was always a sudden one, and much more rapid than in the case of the grains in the other cells. This may be well observed in *Bryonia dioica*, in which the rings of the grains in the pores instantaneously appear on the change of colour, which takes place immediately iodine touches the nectary; whereas the grains in the other cells gradually and slowly assume the blue colour. All these grains, whether they take a blue or brown tint, have no dark spot in the centre nor any trace of layers, but consist of one uninterrupted mass of matter. The seven plants, the grains in the pores of which are coloured blue by iodine, are the following: *Bryonia dioica*, L., *Geranium Robertianum*, L., *Parnassia palustris*, L., *Sinapis alba*, L., *Cnicus lanceolatus*, Willd., *Scrophularia Balbisii*, Hornem., *Rubus fruticosus*, L. The fourteen plants, the grains of the pores of which iodine colours dark brown, are the following: *Campanula Trachelium*, L., *Carlina vulgaris*, L., *Calendula officinalis*, L., *Centaurea scabiosa*, L. (flower of the disc), *Senecio sylvaticus*, L. (flower of the disc), *Sonchus arvensis*, L., *Circea lutetiana*, L., *Cichorium Intybus*, L., *Reseda luteola*, L., *Samolus Valerandi*, L., *Helianthus annuus*, L. (flower of the disc), *Tanacetum vulgare*, L., *Hieracium pilosella*, L., *Helminthia echioides*, Gaertn. In all these cases, whether the grains of the pores are coloured blue or brown, the grains of the other cells assume a yellow or brown tint, except *Bryonia dioica*, in which they become blue, and *Sinapis alba*, L., in which they take a brownish-blue tint.

The inquiry now presents itself, what is the granular matter in the nectaries and their pores which is coloured brown by iodine? I cannot state established facts in reply, but only advance the hypothesis, that it is a starch-like substance, from which the sugar of the nectary might be easily produced. I am urged to this conclusion by the following reasons:—

1st. The brown-tinted grains of the nectaries are in their physical properties, such as form, magnitude, colour and situation, exactly similar to the grains of the eleven or twenty-two plants,—as we include in the number those four plants the grains of which take a blue-

brown colour, as well as those seven the pore-grains of which assume a blue tint,—which grains iodine proves to be real starch. It would be remarkable indeed, if the substance in the former were not also of a similar nature to starch,—if it were not in fact isomeric with starch.

2ndly. It would also be most remarkable, if plants of the same family, the nectaries of which agree with one another in situation and structure, should in some cases contain starch in the nectary and in others a different substance. Amongst the *Labiatae*, for instance, it is indisputable that the nectaries of *Mentha arvensis* and *Clinopodium vulgare* contain starch. It would be extraordinary indeed if the contents of the nectaries of many other *Labiatae*, as of *Stachys sylvatica* and *arvensis*, *Prunella vulgaris*, *Lamium album*, &c., were not also starch, although they are turned brown by iodine, for their nectaries are in all other respects exactly similar to those of the first.

3rdly. The elements of starch (C^{12} , H^{10} , O^{10} *) form also with the same number of atoms three or four other substances, dissimilar in their chemical and physical properties, viz. cellulose, inuline, dextrine, and lichen starch. Schleiden, however, in his 'Wissenschaftliche Botanik,' 1846, does not consider lichen starch as a distinct substance, although Mulder in his 'Chemistry of Vegetable and Animal Physiology,' which I have before me only in an English translation by Fromberg, without date, regards it as a chemically distinct body. When will the time come when chemistry will state results on these important substances which will meet with general acceptance? It is certain, at all events, that the chemical combination of C^{12} H^{10} O^{10} constitutes a most variable substance. Although we may never be able by direct analysis to prove the identity of the granular matter in the nectaries, which is coloured brown by iodine, and the formula C^{12} H^{10} O^{10} , there is nothing to prevent us from assuming the identity, and concluding that the contents of the nectary, which are coloured brown by iodine, are isomeric with starch. From this substance, therefore, and the nitrogen contained in the pollen and ovules, the sugar of the nectar results.

Cringleford, near Norwich, April 1849.

On the Intimate Structure of Articular Cartilage. By Dr. LEIDY.

As is familiar to every anatomist, articular cartilages always fracture in a direction perpendicular to their surface, the broken edge presenting a striated appearance in the same direction. This character the older anatomists ascribed to a fibrous or columnar structure of the cartilage, like that of the enamel of the teeth, while histologists at the present day consider it as dependent upon the vertical arrangement of the rows of cartilage-cells, although it has been suspected to depend upon some ultimate arrangement of the matrix or intercellular substance not yet detected. In some late observations upon the structure and development of articular cartilage, through means of an excellent microscope, made for me by

* I quote from Mulder's 'Chemistry of Animal and Vegetable Physiology.'